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Production of Mulit-kilovolt X-rays From Laser-heated Targets *

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X-ray sources in the 4-10 keV x-ray regime can be produced by laser irradiating high-Z targets with high powered lasers. Line emission from solid targets irradiated by lasers typically produce conversion efficiencies of 2 - 10 % over ns-timescales. In these experiments, we investigate the use of underdense targets to produce multi-kilovolt x-rays. Calculations of novel target designs show that confined plasmas can have efficiencies of ~ 15 %.

We use 20 kJ of 0.35 μm laser light from Nova to volumetrically heat Xe gas confined in low-Z enclosures. Confinement of the plasma is predicted to increase the conversion efficiency into hard x-rays. These sources are of interest because they can be used as bright x-ray backlights for the proposed National Ignition Facility and for testing of material damage thresholds.

The targets are cylindrical Be enclosures that are filled with 1 - 2 atms with Xe gas. The emission > 4 keV is primarily due to L-shell transitions and bremsstrahlung. Diagnostics include time-independent x-ray spectra to obtain the conversion efficiency and time-resolved spectra to monitor the temporal behavior of these sources. In addition gated x-ray imagers provide a measure of the volume in emission. Measurements will be presented for targets of varying pressure and laser energy and compared to calculation.

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